31. Delaware, 31. District of Columbia, 31. Georgia, 4, 9, 22, 25. Idaho, 24, 28. Illinois, 1, 2, 3, 12, 16, 18, 19, 20, 21, 22, 29, 30. Indiana, 6, 16, 17, 19, 30, 31. Indian Territory, 3, 11, 17. Iowa, 1, 15, 17, 18, 19, 20, 21. Kansas, 8, 9, 13, 23, 26. Kentucky, 4, 16, 30, 31. Louisiana, 3, 8, 9, 10, 13, 14, 15, 30, 31. Maine, 5, 20. Maryland, 3, 17, 19, 31. Massachusetts, 4, 19, 20, 31. Michigan, 2, 4, 5, 19, 20, 30, 31. Minnesota, 19, 20, 26. Missouri, 3, 11, 12, 18, 19, 21, 22, 30. Montana, 1, 19. Nebraska, 19. Nevada, 20. New Hampshire, 4, 5, 20, 21, 30, 31. New Jersey, 4, 17, 19, 20, 31. New Mexico, 8, 9, 10, 17. New York, 4, 17, 19, 20, 21, 22, 31. North Carolina, 2, 3, 4, 11, 12, 13, 31. North Dakota, 20, 28. Ohio, 4, 19, 30. Oklahoma, 8. Oregon, 1, 11, 13, 14, 17, 18, 19, 20, 21, 28, 29, 30, 31. Pennsylvania, 4, 5, 17, 19, 20, 31. South Carolina, 8, 9, 10, 12, 15, 25. South Dakota, 6, 7, 12, 20. Tennessee, 4, 17, 30, 31. Texas, 7, 8, 9, 14, 15, 18, 19, 24, 31. Utah, 2. Vermont, 4, 5, 20, 21. Virginia, 3, 4, 11, 17, 31. Washington, 4, 6, 18, 19, 20. West Virginia, 4, 17, 19, 31. Wisconsin, 19, 20, 24. Wyoming, 30.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 2. Arizona, 8, 9, 10. Arkansas, 31. California, 8, 9, 19, 20, 29, 30. Washington, 17, 19.

SNOWFALL.

The total snowfall for the current month is given in Tables I and II, and its geographic distribution is shown on Chart VIII. The limit of snow at the end of the month was much farther south than at the same time a year ago. The snowfall of the Plateau region as a whole was perhaps a little above the average, although the fall over small areas here and there was not up to the average. The snowfall of the mountainous regions of Arizona, New Mexico and Colorado, from the best information available, seems to have been considerably above the average. The snowfall of the upper Mississippi and Missouri Valleys was a trifle heavier than for the corresponding month a year ago, while the average depth in New England was not so great as in 1897. Little snow fell east of the Appalachians south of Lynchburg, Va., and the fall of western Georgia and Alabama was also quite light. The fall of the Sierra Nevadas in California seems to have been below the average.

The depth of snow on the ground at the end of the month.—The southern limit of snow on the ground at the close of the month was slightly farther south than on the corresponding date a year ago. The ground was free from snow, however, over considerable areas north of the southern limit of no snow, particularly in southern Ohio and Indiana, Illinois and a considerable portion of North Dakota. A greater portion of the Plateau region was covered with snow at the end of the month than was the case a year ago; and this was also the case on the Upper Peninsula of Michigan and in northern Wisconsin.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of pressure on the evaporation and therefore on the temperature of the wet-bulb thermometer has had the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

The current month.—The month was cold and deficient in rainfall in a majority of districts, and we should, therefore, expect low absolute humidity and relatively clear skies.

Relative humidity was above normal in seven districts, exactly normal in five and below in the remaining nine, as against six, four, and eleven, respectively, in November, 1898, whence it appears there was a slight increase in the relative humidity of the air but not in the absolute humidity.

The greatest changes in the relative humidity of the current, as compared with the preceding, month occurred in the southern Plateau, viz: from 10 per cent below normal to 1 per cent above. The drought on the Pacific coast, noted in the November REVIEW was intensified considerably during December, there being an increase in the dryness of the air throughout the entire region.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	+ 1	Missouri Valley	75	0
Middle Atlantic	74	0	Northern Slope	68	+ 1
South Atlantic	75	− 4	Middle Slope	71	+ 6
Florida Peninsula	82	0	Southern Slope	72	+ 5
East Gulf	75	− 3	Southern Plateau	49	+ 1
West Gulf	78	0	Middle Plateau	65	− 2
Ohio Valley and Tennessee	75	0	Northern Plateau	81	0
Lower Lake	77	− 1	North Pacific Coast	82	− 6
Upper Lake	83	+ 2	Middle Pacific Coast	66	−18
North Dakota	78	− 1	South Pacific Coast	56	−18
Upper Mississippi Valley	78	+ 2			

WIND.

The winds of the month were not unusually boisterous for the season. The Gulf storm of the 4th and 5th was attended by winds of high velocity in its course from the Mississippi Valley to the Lakes. The majority of the high velocities

given in the table below occurred in connection with that storm.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Albany, N. Y.	4	54	e.	El Paso, Tex.	3	52	ne.
Do.	5	60	ne.	Fort Canby, Wash.	1	54	se.
Atlantic City, N. J.	4	50	se.	Do.	10	50	e.
Baltimore, Md.	4	54	e.	Do.	18	78	se.
Block Island, R. I.	4	69	e.	Do.	26	50	se.
Do.	5	64	e.	Do.	31	64	se.
Boston, Mass.	5	50	e.	Havre, Mont.	27	50	sw.
Buffalo, N. Y.	5	55	w.	Independence, Cal.	28	60	nw.
Do.	6	52	w.	Do.	29	66	nw.
Do.	7	58	w.	Knoxville, Tenn.	4	50	sw.
Do.	8	51	w.	Mount Tamalpais, Cal.	8	55	ne.
Do.	10	62	w.	Do.	9	61	ne.
Do.	11	51	sw.	Do.	28	62	nw.
Do.	14	54	w.	Do.	29	60	nw.
Do.	18	51	w.	Nantucket, Mass.	4	52	se.
Do.	22	58	w.	Do.	5	54	se.
Do.	23	68	sw.	New Haven, Conn.	5	54	se.
Do.	24	50	w.	New York, N. Y.	4	78	e.
Do.	27	56	w.	Do.	5	54	nw.
Cape May, N. J.	4	67	e.	Do.	13	50	w.
Cleveland, Ohio	5	60	w.	Do.	28	60	w.
Do.	22	50	sw.	Portland, Me.	5	50	e.
Do.	27	51	w.	Winnemucca, Nev.	8	52	n.
Eastport, Me.	5	72	e.	Do.	28	51	nw.

It will be noticed on examination of the above table that maximum wind velocities of over 50 miles per hour occurred at two stations on the middle Plateau (Winnemucca, Nev., and Independence, Cal.) on the 28th.

On turning to the daily weather maps of that date, we were unable to find any explanation of the high winds in the pressure gradients as delineated on the morning or night charts. On examining the barograph trace of the Winnemucca station, however, it seems quite probable that a secondary depression formed in the Great Basin during the 28th and moved eastward north of Carson City and Winnemucca, passing the latter point at about 6 p. m., seventy-fifth meridian time.

High winds prevailed on the California coast on the 9th, and over southern California on the 23d–24th, the latter being accompanied by clouds of dust blown from the deserts to the northeastward.

The winds on the western slope of the Rocky Mountains, particularly over northeastern Utah, were destructive on the night of the 8–9th. Buildings were unroofed, and in a few cases wrecked, and there was general destruction of shade trees, awnings, signs, etc.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

The current month.—Considering the high pressure that prevailed during the month, we should expect relatively clear skies west of the Mississippi. This was so only in a measure, as may be seen by the departures in the table below. There was more than the normal cloudiness over the southern Plateau, particularly in southwestern Arizona, which region is, ordinarily, more free from clouds than any other. The influence of the Great Lakes in producing cloud is remarkably well shown on the chart for the current month, No. VII. The vertical temperature gradient of the cold, dry air that moves easterly over the comparatively level lands of Minnesota and Wisconsin is probably not disturbed, at least in fair weather, until the lakes are reached, and so long as it remains constant, or nearly so, there is no tendency to form cloud. When, however, the relatively warmer air over the lakes is reached, a portion of the water vapor in the air is condensed and becomes visible as cloud, and the latter is carried eastward in the prevailing winds. The greatest effect is naturally felt on the eastern shore of the lakes whose longer axis runs at right angles, or nearly so, to the direction of the prevailing winds. The clouds formed over Lake Michigan are not immediately dissolved as soon as they pass beyond the shores of the lake, but are carried eastward, giving character to the weather over the interior of the State and even beyond. One of the direct results of the cloudiness of the eastern shore of Lake Michigan is the immunity from severe frosts and extremely low temperatures enjoyed by that region.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.9	+0.1	Missouri Valley	4.5	−0.6
Middle Atlantic	5.5	+0.1	Northern Slope	4.5	−0.1
South Atlantic	5.5	+0.8	Middle Slope	3.6	−0.4
Florida Peninsula	5.0	+0.4	Southern Slope	3.6	−0.8
East Gulf	5.6	+0.4	Southern Plateau	3.2	+0.2
West Gulf	5.1	−0.2	Middle Plateau	4.4	−0.7
Ohio Valley and Tennessee	5.5	−0.6	Northern Plateau	6.3	−0.8
Lower Lake	8.0	+0.4	North Pacific Coast	6.7	−0.6
Upper Lake	6.5	−0.6	Middle Pacific Coast	4.7	−0.7
North Dakota	4.1	−1.1	South Pacific Coast	3.8	−0.6
Upper Mississippi Valley	4.5	−1.2			